Amendments to the Claims

This listing of claims will replace all prior listings of claims in the application.

Listing of Claims

1. (Currently Amended) A method for culling small objects in a system for shading 3-dimensional computer graphics images, comprising the steps of:

subdividing a display on which an image is to be viewed into a plurality of rectangular areas;

for each rectangular area, deriving a list of objects in the image which may be visible in that rectangular area; and

using the list of objects to determine how the rectangular area should be shaded for display;

wherein ~~characterized in that~~ the step of deriving a list of objects comprises the steps of:

determining maximum and minimum values for each object in x and y directions;

for each object in the image, determining a bounding box from the maximum and minimum values of the x and y coordinates of the object;

determining a set of sampling points from the maximum and minimum values;

determining whether or not a bounding box surrounding the object covers any of the sampling points;

culling the object if the bounding box misses all the sampling points;

testing each sampling point against each edge of the object;

determining from the test performed by the testing step ~~means~~ whether or not the object covers any sampling point; and

adding or rejecting the object from the list
in dependence on the result of the determination.

2. (Original) A method according to claim 1 including
the step of determining whether or not the separation of the
sampling points in the x and y directions exceeds the
resolution of the display; and adding or rejecting the object
from the list in dependence on the result of the
determination.

3. (Original) A method according to claim 2 in which
the resolution of the display comprises the pixel separation
of the display.

4. (Cancelled)

5. (Currently Amended) The method according to claim 1
further including the step ~~where~~ of, for each object,
selecting only those rectangular areas which fall at least
partially within the object's bounding box when determining
whether or not that object is to be added to the list for a
rectangular area.

6. (Currently Amended) A method for shading 3-
dimensional computer graphics images comprising the steps of:
    subdividing a display for an image into a plurality of
rectangular areas;
    for each object in the image, determining a bounding box
of rectangular areas into which the object may fall;
    testing edge information from each object against a
consistent sample point in each rectangular area to determine
whether or not the object falls into each of the rectangular
areas in the bounding box; and
    inserting the object in an object list for a rectangular
area in dependence on the result of the determination; ~~and~~

wherein ~~characterized in that~~ the step of testing edge information includes the step of shifting the edge information by a predetermined amount in dependence on the orientation of each edge.

7. (Original) A method according to claim 6 in which the step of shifting edge information comprises shifting by either the vertical or horizontal dimension of a rectangular area.

8. (Original) A method according to claim 7 in which the shifting step is performed using a floating point calculation.

9. (Previously Presented) A method according to claim 6 in which the shifting step is performed with a safety margin whereby objects will be included in object lists for a rectangular area if the edge information falls close to a sampling point.

10. (Currently Amended) An apparatus for culling small objects in a system for shading a three-dimensional computer graphics image, comprising:
means for subdividing a display on which the image is to be viewed into a plurality of rectangular areas;
means for deriving for each rectangular area a list of objects in the image which may be visible in that rectangular area; and
means for determining how the rectangular area should be shaded for display by using the list of objects;
wherein ~~characterized in that~~ the means for deriving a list of objects comprises:~~object comprises;~~
means for determining maximum and minimum values for each object in X and Y directions;
means for determining, for each object in the image, ~~determining~~ a bounding box from the maximum

and minimum values in the x and y directions;

means for determining a set of sampling points
from the maximum and minimum values;

means for determining whether or not the
bounding box surrounding the object covers any of
the sampling points;

means for culling the object if the bounding
box misses all the sampling points;

means for testing each sampling point against
each edge of the object;

means for determining from the test performed
by the testing means whether or not the object
covers any sampling point; and

means for adding or rejecting the object from
the list in dependence on the result of the
determination.

11. (Original) The apparatus according to claim 10
including means for determining whether or not the separation
of the sampling points in the X and Y directions exceeds the
resolution of the display; and means for adding or rejecting
the object from the list in dependence on the result of the
determination.

12. (Original) Apparatus according to claim 11 in which
the resolution of the display comprises the pixel separation
of the display.

13. (Cancelled)

14. (Previously Presented) The apparatus according to
claim 10 further including means for selecting for each object
only those rectangular areas which fall at least partially
within the bounding box of the object when determining whether
or not that object is to be added to the list for a
rectangular area.

15.   (Currently Amended)   Apparatus for shading a three-dimensional computer graphics image comprising:

means for subdividing a display for an image into a plurality of rectangular areas;

means for determining for each object in the image a bounding box of rectangular areas into which the object may fall;

means for testing edge information from each object against a consistent sample point in each rectangular area to determine whether or not the object falls into each of the rectangular areas in the bounding box; and

means for inserting the object in an object list for a rectangular area in dependence on the result of the determination;

wherein ~~characterized in that~~ the means for testing edge information includes means for shifting the edge information by a predetermined amount in dependence on the orientation of each edge.

16.   (Original)   An apparatus according to claim 15 in which the means for shifting edge information comprises means for shifting by either the vertical or horizontal dimension of a rectangular area.

17.   (Original)   An apparatus according to claim 16 in which the shifting means uses a floating point calculation.

18.   (Previously Presented)   Apparatus according to claim 15 in which the shifting means uses a safety margin whereby objects will be included in object lists for a rectangular area if the edge information falls close to a sampling point.

19.   (Previously Presented)   The method according to claim 1 including the step of determining whether or not the sampling points are spread by more than 1 x 1 pixel and not

testing the object for culling if the sampling points exceed this limit.

20. (Previously Presented) The apparatus according to claim 10 further including means for determining whether or not the sampling points are spread by more than 1 x 1 pixel in the x and y directions; and not testing the object for culling if the sampling points exceed this limit.